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ABSTRACT

A functional typology of verbal instructional tasks for advanced classroom instruction and inservice training is described and illustrated in this paper. The described typology is based upon functional definitions of elementary and conceptual behavior and incorporates the kinds of goals and objectives that surveys and research have shown to be important for experienced learners within B. F. Skinner's verbal classification system. Procedures for selecting proficiency criteria for tasks in the typology are described and problems with current schemas for classifying objectives and advantages of the present schema are discussed. The paper also reports on a series of validation studies in which ten subjects read a subsection of an instructional program to teach the typology and classified 20 tasks taken from various sources. It reports that high agreement was attained between typology designer and subjects' classification of tasks after a short training session, and that subjects were unable to list any objective that could not be classified in the typology. The paper then discusses the data in terms of subsequent improvement of the typology and program, future validation studies, standardization of instructional research and practice, implications for research on transfer of control across classes of verbal behavior, implications for research on building fluency of adult behavior, and efficiency in instructional design. (Author/FL)

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Behavior Analysis in Instructional Design: A Functional Typology of Verbal Tasks [1]

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Defining the Problem

Instructional tasks taught in higher education classrooms and professional or inservice training programs should focus upon the behavior of professionals or advanced students in a discipline (Bostow, 1976; Markle, 1969). A student who "really understands" a subject matter behaves like its content experts under the same conditions as they do (Markle & Tiemann, 1970). Content experts can state the facts and figures of their field. They can relate seemingly obscure similarities between concepts and otherwise synthesize information in novel analyses. They can identify real-world instances of the concepts developed in their fields, and can provide intriguing examples of these concepts. They can ask questions and determine methods for answering these questions, or when faced with a problem they can design strategies for solving it.

Professionals or advanced students in a discipline do not rely upon pre-memorized situations or reponses to demonstrate their expertise, but can engage in all of the aforementioned behaviors under novel conditions. In addition, professionals can engage in these behaviors at rates that make the behaviors maximally useful to themselves or others. Many individuals may be able to sucessfully engage in these behaviors given enough time, but that does not make them proficient. Performance is judged according to its quality and pace (Haughton, 1979). Proficient performance is accurate and fluent. Transmitting the culture in high school, college and professional training programs means teaching students to behave under the same conditions and at the same levels of proficiency as professionals do.

What is the discrepancy, if any, between competence in the real world anc current instructional practice to promote such competency?[1] To answer

this question, we began with some claims (e.g., Bostow, 1976; Markle, 1969; Popham, 1975) and our own suspicions that most formal adult instruction ignores most of the goals and criteria that we outlined above. A search through educational research literature for substantiation of these claims revealed eight surveys of reasonable methodological quality. Gall (1970) indicated that 60% of the questions asked by teachers require students to supply a technical term or proper name from an important sentence taken from an instructional presentation. Scannel and Stellwagen (1960) and Tyler and Okumn (1965) found that well over 50% of the questions teachers ask in their presentations and on their tests require rote recall of information. Lawrence (1963) was able to classify 98% of the social studies test items that he collected from 63 high school teachers in the lowest (knowledge) category of Bloom's taxonomy of educational objectives (Bloom, Englehart, Furst, Hill and Krathwohl, 1956). None could be classified as requiring analysis, synthesis or evaluation, the three upper categories in Bloom's taxonomy. Stanley and Bolton (1957) found that 51% of the standardized test items that he randomly selected were at the knowledge level of Bloom's taxonomy. Our own survey of twenty commercially available study guides in Introductory and Educational Psychology revealed that only ten contained tasks that required more than regurgitated definitions and descriptions contained in the texts they accompanied. Eighty-seven percent of the 1231 tasks we sampled from these study guides required the student to copy information from their texts (Chase, Johnson & Keenan, 1977). Semb and Spencer (1976) reported that over 90% of the examination items of instructors they surveyed asked for rote recall. To make matters worse, the same instructors read the authors' definitions of recall and complex instructional tasks and estimated that one third of their examination items went beyond the level of recall ! Similar results were obtained in surveys of high school teachers

(Pfeiffer, 1967; Pfeiffer & Davis, 1965). Finally, no survey revealed instruction based upon objectives that had proficiency criteria. We concluded that our initial suspicions and the claims of others were true: most of the formal instruction that adults receive today requires specific memorized responses to specific sets of stimuli, with little or no attention paid to either proficiency or the conditions under which student performance takes place.

Inadequecies of Current "Solutions"

The surveys reported above prompted us to ask a number of further questions. Has anyone attempted to reduce the large discrepancy between real-world competence and instruction designed to promote it? Has anyone attempted to precisely specify goals important for adult learners? In our search through the goals-and-objectives literature, we uncovered five schemas for classifying instructional tasks for adult learners (American Association for the Advancement of Science, 1965: Bloom et al., 1956; Gagne,1971 [2]; Gerlach & Sullivan, 1967; Williams, 1977).[3] As the authors of each schema dutifully indicate, there are many advantages of instructional task classifications, among them their function as prompts for increasing the range of instructional tasks incorporated in the teaching of a subject matter; standardized terminology, definition, and facilitated communication across specialists in the educational system; more accurate planning and comparison of instruction and evaluation procedures; and promotion of systematic thinking and writing about the goals of instruction.

Despite the virtues of task classification systems, there are five major problems that variously plague current schemata. First, the categories of some schemata describe mental operations that are presumed to underlie overt verbal

behavior. For example, the most influential task classification schema is Bloom's taxonomy of educational objectives for the cognitive domain (Bloom, et al., 1956; Krathwohl, 1964). The six classes within their taxonomy are "knowledge," "comprehension," "application," "analysis," "systhesis," and "evaluation." Bloom himself recognized the problem of using inferential constructs by saying that it is not always possible to know whether a student's answer was a product of "high or low level cognitive process" (1956). Further, it is not at all clear how these classes of inferred mental operations are comparable across various subject matters. How is 'synthesis' in physics like 'synthesis' in spelling or poetry? Sullivan (1969) reports an experiment in which subjects were taught to complete tasks related to natural science concepts. These tasks were assumed to correspond to each mental operation in Bloom's taxonomy. This training did not facilitate performance on social science tasks assumed to correspond with the same mental operations. This training ing did not facilitate performance on social science tasks assumed to correspond with the same mental operations. Thus, the presumed mental operations training did not transfer.

Besides problems arising from inferring common mental operations across instructional content, classification schemata that focus upon internal unobservable behaviors make it difficult to precisely determine how a given instructional task should be classified. For instance, some might classify the task of defining an idea at the "knowledge" or "comprehension" level of Bloom's taxonomy. If a content expert indicates that the idea is comprised of many simpler ideas, the task might be reclassified as "synthesis". Several studies comparing agreement among subjects' classification of tasks into schema categories have yielded poor results (McGuire,1963; Popham, 1969; Stanley & Bolton,1957; Williams, 1977). No classification schema is of practical value until high agreement among users is achieved through empirical testing among a sample of practitioners and revision on the basis of individual performance errors (Markle, 1967).

At least one classification schema based on observable behavior has produced fairly high agreement among users (Williams, 1977). Others based upon internal constructs have fared far worse (McGuire, 1963; Popham,1969; Stanley & Bolton, 1957).

A third major problem, one that plagues all of the aforementioned schemas, is their focus upon formal or structural properties of objectives and their neglect of the conditions under which the task will be performed. To quote Markle and Tiemann (1970)

> A long essay relating various trends (supposedly "synthesis') can represent rote learning, while a multiple-choice selection of the date of some event (supposedly "knowledge") can represent some high-powered analytical thinking. (page 44)

A good "discovery learning program" may get the high school or college student, or professional in the real-world, to classify an example of a concept, illustrating sophisticated conceptual behavior. The same example may be presented in an "expository learning program". Student classification of the example at a later date will illustrate memorization. Classification depends much more upon the relation between the learner's task and previous instruction than upon the particular words used in the task. The past behavior of the teacher and student should help define the relation between successful completion of an instructional task and the behavior of a professional.

A fourth problem with some current classification schemas is their assumption that instructional tasks can be arranged in a taxonomy or hierarchy from simpler to more complex (e.g., Bloom, et al., 1956; Krathwohl, 1964; Gagne, 1971). For example, in Bloom's taxonomy it is assumed that tasks classified at the "comprehension" level are less difficult and less complex than "analysis" level tasks. "Analysis" tasks are said to subsume "comprehension" tasks. If a student is observed engaging in an "analysis" task such as creating a compound out of two or more elements, it is assumed that he can engage in lower, "comprehension" level "prerequisites" such as telling which of

several substances are compounds. Further, the concept of a heirarchy presumes that teaching a lower level task will not lead to correct performance on a higher level task. Hierarchical assumptions also dictate that a student who fails a low level task will also not be able to complete a high level task. These hierarchical assumptions are not often supported by empirical evidence (e.g., Johnson, 1966; White, 1973). The lack of empirical support is due to at least three related factors. First, while it is clear that hierarchies of prerequisite behaviors for learning a task do indeed exist (Gagne, 1977; Tiemann & Markle, 1978; White, 1973) there is not always a one-to-one correspondence between the prerequisite behaviors an instructional task is intended to evoke, and the behaviors actually evoked by it. This discrepancy will be especially hard to detect when the prerequisite behaviors are described as inferred unmeasurable mental operations, and when the classification of a task is not dependent upon knowledge of the learner's history of instruction (Kropp, Stoker & Bashaw, 1966). For example, if an instructional task asking for a "synthesis" of economic concepts is presented in order to be sure that a student has this prerequisite operation in his repertoire, the student may complete the task correctly on the basis of a "synthesis" he read and memorized without the teacher's knowledge. The prerequisite "systhesis" repertoire may not then be available when the instructor presents an "evaluation" task that requires it. Second, all tasks classified at a higher level in current taxonomies are not necessarily more "complex" in the sense that their completion requires correct responses to tasks classified at lower levels. For example, prerequisite behavior for criticizing an illustration of a concept ("evaluation" level in Bloom, 1956) may not necessarily require correct completion of a "lower level" task such as classifying a desirable range of illustrations as examples or nonexamples of that concept ("comprehesion" level in Bloom, 1956). Third, not all kinds

of learning, let alone instructional tasks, are arrangable in a hierarchy (Gagne, 1973; 1977). The concept of "heirarchy" seems best to describe particular behaviors involved in learning a segment of subject matter, not the general arrangement of instructional tasks (Markle, 1978). Williams (1977) has suggested the term typology for instructional task classification schemata that do not make presumptions about task difficulty, task prerequisites, or transfer of training from one task to another.

A fifth problem with current strategies for classifying instructional tasks is really an error of omission rather than comission. All discussions of task classification schemata focus exclusively on the qualitative features of behavior, to the neglect of fundamental temporal characteristics. Behavior's pace is as important as its quality. Accuracy alone is not sufficient. The airline pilot who can accurately lower the wheels of his jet will be ineffective if he doesn't complete this task in a certain amount of time. And so it is, albeit more subtly so, for verbal behavior. While behavior rates indicative of "competence" undoubtedly differ across topographies and disciplines, empirical procedures for determining proficiency criteria are an essential component of the procedures for using any typology of instructional tasks.

In sum, instructional task classification schemas offer a promising solution to the definition of relevant goals for high school and higher education classrooms and professional or inservice training programs. Such schemata can function as effective prompts for writing instructional tasks that teach and evaluate simple and complex behaviors characteristic of the behavior of a professional in a discipline; and can standardize terms, definitions, and communications regarding instruction. However, some current schemas classify instructional tasks on the basis of inferred mental operations. The definitions of such mental operations are unclear, the generality of the inferences across subject matter is suspect, and the classification of tasks into such catagories

is difficult. Instructional task classification schemata should employ categories of overt learner behavior that are based not only on the topography of the desired performance, but also on the conditions under which the performance will occur, and the relation between such conditions and those that prevailed during instruction. Further, a good task classification schema should not make assumptions about task hierarchies without empirical demonstrations of transfer of training and knowledge of the student's prior experience with the subject matter. The term typology rather than taxonomy best reflects the design and use of a good instructional task classification schema. Finally, programs describing the use of an instructional task classification schema should include procedures for determining proficiency criteria for each task catagory.

A Functional Classification of Verbal Behavior

What would a classification schema that includes the range of important goals for adult learners, yet avoids the five deficiencies we presented above look like? Its set of general categories would be devoid of inference to mental operations, and would exhaust the range of observable verbal behavior that illustrated professional competence. In particular, the categories would encompass all of the relations between stimulus conditions and verbal performance, and would recognize the relation between past and present stimulus-performance relations. The categories would also make no assumptions about hierarchies, and would be applicable across the range of subject matters taught in high school and higher education classes and professional and inservice training programs. Finally, the categories would be amenable to empirical determination and proficiency standards. Skinner's (1957) verbal behavior classification system meets each of these requirements.

Skinner's schema includes six stimulus-performance relations. Echoic

behavior is a vocal performance that has point-to-point correspondence with a vocal performance that immediately precedes it: the first part of the vocal performance must match the first part of the vocal antecedent, the second part of the vocal performance must match the second part of the vocal antecedent, and so on. For example, if a speaker said, "Parlez-vous, francais?", an echoic reply would be, "Parlez-vous, francais?". Echoic behavior requires the speaker to listen and speak.

Textual behavior is a vocal performance that has point-to-point correspondence with a written stimulus. Textual behavior resembles the "decoding" component of reading behavior. Textual behavior requires the speaker to look and to speak.

There are two kinds of transcriptive behavior. In copying from text, both the antecedent stimulus and verbal performance are written. There is also a point-to-point correspondence between antecedent and performance. Copying from text requires the speaker to look and write. In taking dictation (verbatim), the antecedent is vocal and the performance is written. There is also point-to-point correspondence between the antecedent and performance, although, like textual behavior and unlike echoic behavior and copying from the text, the antecedent stimulus and the verbal performance are in different modalities. Taking dictation requires the speaker to listen and write.

Intraverbal behavior defines a vocal or written performance that follows a vocal or written antecedent stimulus. Unlike the verbal relations previously described, however, the antecedent has a different form or topography than the performance it occasions. The antecedent and performance components of an intraverbal may be as short as one word, or may contain many words, phrases, or sentences. Translating a sentence. saying the alphabet, paraphrasing statements heard from a tape-recorder, recalling a definition, and reciting a poem are all examples of intraverbals. Intraverbal behavior requires the

speaker to look or listen, and speak or write in other ways.

Intraverbals may be emitted by one person or may involve two or more people. A teacher may initiate a two-person intraverbal by requesting a student to define or describe a concept. The student's answer, be it vocal or written, completes the intraverbal relation. As the student is answering the question, a one-person intraverbal chain occurs: each word, phrase, or sentence sets the occasion for subsequent verbal performance. The "comprehension" component of reading behavior is intraverbal: a person "comprehends" a text when he can describe it in different words. Intraverbals can be quite complex, as in a three-person philosophical debate on epistemology, which includes multiple sources of private and public intraverbal stimulation.

A tact is a vocal or written performance that follows a nonverbal antecedent stimulus. The nonverbal antecedent may be visual, auditory, gustatory, tactile, or olfactory. Describing a new car to a friend as you view it through the showcase window, identifying an example of a triangular shape in a room, naming the kind of leaf that has fallen in front of you, saying when a parent has reinforced a child and when he has punished her as you watch scenes from a videotape, and taking notes at the scene of an accident are all examples of tacts initiated by nonverbal visual antecedents. Naming the key in which a song is sung, the person whose voice you hear in the distance, the flavor of a restaurant's house dressing, a fabric by its texture, or a candle by its scent are all examples of tacts initiated by other nonverbal sensations. Tacts require the speaker to look, listen, taste, feel, or smell; and speak or write.

The mand is a verbal performance initiated by two kinds of establishing operations (Michael, 1978; Peterson, 1978). Establishing operations heighten the reinforcing effectiveness of some stimulus or event.

Some establishing operations are biological, such as conditions of food, liquid or heat deprivation; or aversive stimulation of sensory receptors. Requesting water, candy or a meal, and asking someone to close the window or turn down an excruciatingly loud stereo are all examples of mands controlled by

biologically related events. Some establishing operations are external environmental stimuli or events, such as events that prevent the speaker from completing a task. A request to hand you a hammer when you are on top of a ladder, or a request for information you need to solve a problem are examples of mands controlled by external establishing operations. Some mands may be multiply-controlled by both kinds of establishing operations, as in a request to have the snow shoveled so that you can go to the grocery store.

It is important to understand the experimental-analytic nature of Skinner's classification system. Observation alone may not be sufficient for correct classification of a verbal relation. What looks like a tact relation may be part intraverbal as when someone says, "Those candy eggs really laid me out flat!" Verbal behavior may also be multiply-controlled by verbal and nonverbal stimuli. A verbal relation may be part tact and part intraverbal, as when Robert Young tastes Sanka coffee and says, "It leaves no grounds for complaint!" Verbal relations may also be multiply-controlled by verbal stimuli. One can only know the correct classification of verbal behavior with certainty by manipulating its antecedents or consequences and measuring changes in the performance.

When discussing the tact, Skinner introduced another concept that is critical to the functional typology that we derived from his classification schema Skinner says that previously learned performances may occur in the presence of novel stimuli; stimuli that the speaker has never labeled that way before. Such verbal performances are <u>extended</u>. If the previously learned performance correctly labels or describes the new stimulus, then the speaker is engaging in <u>generic extension</u> of the tact. All of our previous examples of tacts would be generically extended if the antecedents that initiated them were first encounters.[4]

Intraverbal behavior may also evidence extension when its antecedent or performance component is novel. The novelty of an antecedent or performance lies either in its use of equivalent but topographically different word(s) or phrases, or in its variation in word sequence (Johnson & Chase, 1978; 1979). Extended intraverbals are flexible, in contrast to fixed intraverbals whose antecedent and performance components never vary from the first instance (Johnson & Chase, 1978; 1979). The flexibility of an intraverbal may lie in the novelty of its antecedent, performance or both. Intraverbals are also extended when the antecedent and performance components are reversed for the first time. For example, when we ask for a definition of a term after we have presented the definition and asked for the term we are reversing the components of the intraverbal. When the reversal is encountered for the first time, the correct answer illustrates intraverbal extension. Likewise, when we ask for the name of a musical symbol after we have presented the name and asked for the symbol, we are reversing the intraverbal components. Again, if the reversal is novel, a correct answer illustrates intraverbal extension.

Technically speaking, all of Skinner's classes of verbal relations could evidence extension. For example, echoic behavior is extended when a singer sings a song in a key different from the singer he is echoing. Textual behavior is extended when a person correctly "decodes" a word that she has never read before. Transcriptive behavior is extended when symbols copied from text or dictation have never been copied before.

To the extent that a student engages in extension, he is emitting key behaviors that distinguish a content expert from nonexperts. Extended behavior, be it echoic, textual, transcriptive, intraverbal, tact or mand, is what we mean by conceptual behavior. Proficient extension of a variety of classes of behavior, to the full range of novel conditions a professional may encounter, is what we

mean by complex behavior.

In sum, the echoic, textual, transcriptive, intraverbal, tact, and mand define functional relations between all possible antecedent stimuli and performances. Any verbal relation may be memorized or may be extended at proficient rates, showing conceptual behavior. The ultimate goals of adult instruction involve proficient and extended conceptual verbal performances characteristic of a professional in a discipline.

A Functional Typology of Verbal Instructional Tasks

Figure 1 illustrates the net effect of our integration of instructional goals that are important to teach experienced learners, the best of current typologies and taxonomies of instructional tasks, Skinner's verbal behavior classification schema, and the functional definition of conceptual behavior. The typology classifies instructional tasks according to the general verbal relation they illustrate (e.g., intraverbal, tact), the specific behavior they require (e.g., definition, original example), and the student's prior contact with the task, defining the task as either elementary or conceptual. Column 1 lists elementary instructional tasks; those that do not require extension or conceptual behavior. Column 2 lists conceptual instructional tasks; those that do require extension. If the student has previously encountered a completed task during instruction, or has previously completed the task himself, his subsequent completions of the task do not illustrate extension and hence evidence elementary or nonconceptual behavior. The same task may be elementary or conceptual, no matter whether the task occurs during instruction or testing. Extension is determined by the relation between instruction and later behavior, not

Insert Figure 1 About Here

the particular content or wording of the task.

Figure 1

Functional Typology of Verbal Instructional Tasks

Elementary Tasks [1]	Conceptual Tasks [2]
Echoic	Echoic
Textual	Textual
Transcriptive	Transcriptive
Copying vocal statements Copying from text	Copying vocal statements Copying from text
Intraverbal	Intraverbal
Define/Describe	Define/Describe
Example Identification	Example Identification
Example-request	Example-request
Tact	Tact
Combinations	Combinations
Any two or more. Includes tasks requiring mands.	Tact/Intraverbal chains Intraverbal/Intraverbal chains Tasks requiring mands

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[1] Require fixed verbal behavior.

[2] Require flexible, extended, verbal behavior.

Columns one and two each begin with the echoic, textual and transcriptive. Their conceptual versions are often important to teach in foreign language courses; in courses in which vocal intonation is critical, as in theatre and debating courses;and when difficult technical pronunciations or written performances are required,as in physiology and medical courses.[5] In most other courses, however, experienced learners usually do not need direct instruction on such relations. Echoic and textual performances are profitably requested in all courses, however, when students make errors in completing instructional tasks, for they may have simply misread the tasks they incorrectly complete. Since we are focusing upon the experienced learner, a detailed look at the echoic, textual and transcriptive subclass, taking dictation, is beyond the scope of this paper.[6] The subclass of transcriptive, copying from text, however, warrants further discussion.

Both elementary and complex copy tasks are useful when the goal of instruction is to generate intraverbals that have one-to-one correspondence with instructional materials. Copy tasks represent the <u>first step</u> in a program designed to teach the student to repeat the content of instruction in the absence of instructional materials or statements (i.e., as elementary intraverbal behavior). Copy tasks may be useful when memorizing prose or poetry, and when teaching a foreign language, spelling of technical terms, writing of new symbols, number facts, computer commands, names and dates. Copy tasks may also be useful as the first step in teaching a student the elementary intraverbal task of reproducing graphs, figures, tables or symbols in their absence. Finally, copy tasks may also be useful when you wish to assure that a student focuses attention on critical information contained in a portion of text. In this context, a copy task serves as an "observing response".

Any task that specifically requests an answer to be directly copied from instructional materials is a copy task. For example, if a text states that the field of psychology is the study of human behavior, a copy task could ask

the student to define psychology as it was defined in the text. A task that asked the student to define psychology in his own words would not be a copy task. A request for the plural of nucleus would be a copy task if the text specifically states that the plural of nucleus is nuclei. Another example is asking a student to copy the figure in the text that illustrates the I.Q. score distribution in the United States.

Some instructional tasks may encourage copy behavior. Such tasks use words or sequences of words taken directly from the text. For instance, if a text states that "Punishment is defined as ....", the student may very well simply copy the sentence from the text to answer the task, "Define punishment." Likewise, if a segment of text states

> There can be several reasons why an applied behavior analysis program does not achieve its stated objective: the objective, contingencies, or selected procedures may be inappropriate....

The following tasks will encourage copying from text:

1. List several reasons why an applied behavior analysis program may not achieve its stated objective.

2. There can be several reasons why an applied behavior analysis program does not achieve its stated objective: The _____ _____, _____ or selected _____ may be _____...

For the same segment of text, the following task would not encourage copy behavior:

> Behavioral programs may fail in a number of situations. Summarize the possible ways in you own words.

Note that the form of the noncopy task differs from the form stated in the text, and the item asks the student to summarize in his own words.

Copy tasks are greatly overused and often to no real advantage. Unless textual material is very novel or complex, a copy task is probably superfluous.

Most often, they are an insult to the student. Remember, copy tasks only assure that the student will copy what is requested. Any grammar school student with appropriate motor skills can copy. Copy tasks require no real understanding of what is copied. Their use should be restricted to very complex material, and as the first step towards programming objectives that target memorization (i.e., elementary intraverbal behavior).

The elementary intraverbal tasks listed in column one of figure one are fixed: the forms of the antecedent and performance do not vary from instance to instance. The specific variety we have included are tasks requiring (a) memorized definitions, lists, or descriptions (Define/Describe tasks), (b) repeated discriminitions among a specific set of examples and nonexamples of a concept, illustrated by matching, marking, or labeling behavior (Example Identification tasks), and (c) Example-request tasks, in which the example, be it prose illustration, drawing, or map, was previously supplied by the student or instructor.

Elementary tact tasks include repeated vocal or written performances to a specific set of nonverbal stimuli, as when the learner labels a piece of equipment he or the teacher has already named.

Elementary combination tasks include any two or more of the task types in the list, such as identifying an illustration as an example or nonexample (Example Identification task) and justifying the answer (Define/Describe task). Elementary combinations may also illustrate more subtle sequences of elementary behavior, such as correcting a mispronunciation (Example Identification plus Define/Describe task). Combination tasks may also require the student to mand additional information from the instructor, or other persons in order to complete a task correctly. For example, a combination task for describing a particular

fossel might require the learner to mand a listener to tell its location in rock sediment. Similarly, to answer a combination task that asks for the ramifications of a particular therapeutic intervention, the student may need to question different people in the client's living and working environments. Combination tasks may also require self-mands to check written sources. In the elemantary case, the request must have been illustrated or demontrated during instruction.

Column two lists conceptual instructional tasks: those that require extension. We have already discussed the initial three verbal relations. The fourth, conceptual intraverbal behavior, is subdivided in the same way as elementary intraverbal behavior. The subclasses include (a) Define/Describe tasks, (b) discrimination among examples and nonexamples (Example Identification tasks), and (c) Example-request tasks. [7] An instructional passage followed by an illustration of each of these conceptual intraverbal tasks appears below:

> The constructional approach is a relatively new way by which we can deal with the problem behavior of an individual. Currently, most methods for dealing with problem behaviors focus on eliminating a distressing behavior. However, since all behavor, including distressing behavior is maintained by consequences that are desirable to the individual, it is possible to employ these desirable consequences to strengthen other behavior that is not distressing. The constructional approach focuses on changing problem behavior by teaching or suggesting other behaviors that are followed by desirable outcomes or consequences. First, the constructional therapist observes/interviews the client to determine the behavior or class of behaviors that are disturbing to the client or others. In addition, the constructional therapist determines the desirable outcomes that maintain the problem behavior in spite of other disturbing outcomes. Then, alternative behaviors that are maintained by the same critical, desirable outcomes as the distressing behavior, but are accompanied by satisfaction rather than distress are taught or suggested. In addition, the client

learns to perform the satisfying behavior in the same situations that the distressing behavior currently occurs. This approach can be used by professionals with behavioral psychoanalytc, or other therapy orientations. Through self-observation and analysis an individual can also use this approach to change his own behavior.

1. Define the constructional approach in your own words. (Define/Describe task)

2. Which of the following is an example of the constructional approach? (Example Identification task):

   a. Greg was mentally retarded and participated in a workshop to learn to assemble transistor radio parts. He spent much of his time distracting other members of the workshop. They often enjoyed the distraction, and kidded around with him. This caused the supervisor to believe that the kidding around supported Greg's distracting behavior. The supervisor decided that Greg should only be allowed to kid around with the other participants if he was on-task for 15 minutes. This proved to be much better for all concerned, as Greg quickly learned to work diligently for 15 minutes and kid around for 5.

   b. Georgia, a three-year-old attending a local preschool, had a history of whining when things didn't go her way. For example, one day when she was building a house out of blocks, she accidently knocked it over. She immediately started whining and her teacher came right over. The teacher wondered if her coming over to Georgia when she whined helped support this behavior. To find out, the teacher told Georgia to raise her hand and ask for help if she was having any trouble. Otherwise, Georgia would not get any help. This system worked fine: Georgia does not whine, and the whole classroom atmosphere is much better.

3. Give an original example of the constructional approach. (Example-request task).

All three subclasses of intraverbals in column two require extension. and thus are conceptual and flexible. Either the task stumulus, the student's performance, or both must vary from those that occurred during previous instruction. Intravervals vary in their degree of "fixedness" or "flexibleness". These two features in fact define a continuum along which intraverbals may be rank ordered. For example, one text (Vargas, 1977) defines the term, motivation as

> (1) The contingencies for responding--roughly speaking, the "reasons" for working; (2) the degree to which an individual has been deprived or satiated with a particular reinforcer; (3) the extent to which a student's behavior is controlled by the natural consequences of behaving rather than by artificial reinforcers introduced by others--that is, how much enjoyment the student gets out of working. (p. 246)

One student's performance to the Define/Describe intraverbal task, "Define motivation", is verbatim from the text; it is obvously at the fixed end of the continuum, thus falling into the elementary task column of the typology. A second student's performance is as follows:

> The term motivation refers to at least three different phenomena that we may observe. In the first case, a person may be more motivated as the time since his last encounter with a particular reinforcer increases. Conversely, a person may be less motivated if he very recently made contact with a certain reinforcer. These processes are termed, respectively, deprivation and satiation. Motivation may also refer to the strength of the contingencies that control a person's behavior. If the contingencies are very strong, a person will be very motivated and is often said to be highly goal directed or purposive. Finally, motivation may also refer to the extent to which consequences of a person's behavior can be found in his own, natural environment. When reinforcers are arbitrarily selected and delivered in such a way that the person will not behave in a certain way unless he is in this artificial environment, we would probably not say that the person was very motivated.

This performance is obviously at the flexible end of the continuum, clearly falling into the conceptual column of the typology. It has a word order and topography that is quite different from the text book definition. The three kinds of motivation are also presented in a different order than the text presents them.

Many intraverbals straddle the fence between conceptual and memorized (elementary), however. For example, a third student's answer to the teacher's task, "Define motivation", follows:

> (1) the response contingencies or "reasons" for behaving; (2) the degree to which a student's performance is controlled by natural rather than by artificial reinforcers introduced by others--the student's enjoyment for working; (3) the extent to which a person has been satiated or deprived of a certain reinforcer.

Is this performance conceptual or memorized? It's hard to say--most of the words in the textbook definition appear, and in the same order. There is, however, an occasional synonym for the textbook word, and the second and third kinds of motivation are reversed. This might simply indicate a weak elementary intraverbal performance, however! We would probe this student further before we were confident that he "really understood" what motivation was.

We might be more confident that the third student's performance was conceptual if the antecedent that occasioned the student's definition was different from "Define motivation". For example, if the teacher asked the student to comment upon the fact that the high school dropout rate was steadily increasing (a fact never discussed in the text), her near-verbatim definition of motivation might very well indicate that she "really understood" the term, even though her answer sounded like the textbook author's definition.

Both Example Identification tasks and Example-request tasks are also

intraverbal and hence may vary in their degree of flexibleness. In Example Idenfification tasks, the scenario presented for classification may be very similar to or very different from the scenarios presented in earlier instruction. Likewise, the student's example in an Example-request task may be very similar to or very different from those presented during instruction. As with Define/Describe intraverbal tasks, our confidence in conceptual learning increases to the extent that Example Identification task stimuli are significantly different from those presented in instruction. Likewise, student examples should be "truly original".

Our subclasses of flexible intraverbals by no means exhaust the range of conceptual intraverbal behavior in which competent professionals engage. Specific curricula and classroom settings may require other topographical indicators of flexible intraverbal behavior. For example, intraverbal tasks in mathematics and statistics are not explicitly identified by one of our subclasses. Neither are many performances emphasized in lists of objectives for children. For example, spelling, while techinically a Define/Describe-each-letter-in-a-word task, is not listed. One advantage of our typology is that it provides observable, general categories from which instructors can design relevant subclasses of tasks for their specific courses, in contrast to the unobservable general categories of other classification systems. Indeed, discipline-specific instructional task types designed from a set of general observable categories may provide a better model for instructional design than attempts to design classification systems that contain "universal" task subclasses.

While our subclasses of intraverbal tasks are not exhaustive, they are useful in teaching a wide range of goals for adult instruction. Define/Describe intraverbal repertoires certainly increase the efficiency of learning new

verbal and nonverbal behavior; later teaching can then rely upon instructions rather than direct contact with environmental contingencies. Most instructional designers consider extended intraverbal and tact classification (identification) behavior as the sole evidence of conceptual performance (e.g., Gagne, 1977; Tiemann & Markle, 1978; Vargas, 1977). Others (e.g., Anderson, 1972; Tennyson & Park, 1980) consider Example Identification and Example-request evidence of conceptual performance. Example Identification and Example-request tasks are also excellent alternatives to tacts and nonverbal task performance when the real-world environments in which professionals behave are not readily available. As such, they may be considered close approximations to real-world conceptual behavior and may help to facilitate it.

Some examples of combination tasks were illustrated in our discussion of elementary instructional tasks. There are countless other examples that have different topographies, but that conform to our functional definition. Here is one more:[8] A text discusses the relations among the demographics of the people in a voting precinct, the kinds of political candidates that have been elected in the precinct, and the probablities of new candidates being elected if they have various perspectives on issues like the economy, energy consumption, and foreign military policy. A combination task for the text is illustrated below:

> Below are biographical sketches of the residents in three precincts. Accompanying each sketch is a detailed description of successful and unsuccessful candidates in prior elections. Describe the candidate whom you would predict would be the most likely to win an upcoming election. Say why you have chosen such a candidate. (Imagine the "sketches"!)

Notice that the student must engage in three subclasses of behavior in order to complete this combination task: (a) he must discriminate political trends from nonpolitical trends (Example Identification); (b) he must describe the

characteristics of a candidate most likely to win (Example-request); and (c) he must justify his descriptions in terms of the general rules of political relations discussed in the text (Define/Describe). The following are a sample of the kinds of stems that begin combination tasks:

a. Predict the outcome of the following... and justify your answer.
b. If the following passage is an example of...then justify your answer. If it is not, then rewrite the passage to make it illustrate...
c. Change the nonexamples in the following scenarios to examples of...
d. Change the examples in the following scenarios to nonexamples of...
e. In the following illustrations, identify the examples of...and justify your choices by keying the components of the definition to the components of the illustrations.
f. Write an essay in which you describe the relation between...and...Illustrate your relation with examples and nonexamples.
g. Record the following behavior, graph it, and answer the following questions:

Note that most combination tasks are not simple arbitrary sequences of unitary verbal relations, but rather require "responding to classes of objects or events with classes of relations," remeniscent of Gagne's most complex intellectual skill, rule-using (1977). For example, in the task, "If the above passage is an example of..., then justify your answer. If it is not, then rewrite the passage to make it illustrate... ", the student is not simply engaging in a unitary, albeit conceptual, performance like identifying the illustration as an example or nonexample. Rather, the student is responding to the illustration with another verbal relation, either Define/Describe, or Example-request behavior. Likewise, a combination task that asks the student to change a nonexample to an example requires rule-using to arrange for a desired outcome. Other combination tasks require behavior characteristic of "prediction" and "evaluation". Instructors should strive to design

combination tasks that require conceptual rule goverance.

Tasks that explicitly or implicitly combine two or more of the subclasses of tasks in the typology should be presented after tasks that require each of the subclasses. Most combination tasks are truly terminal in that their component performances are prerequisites. While the component subclasses of combination tasks may have sequential dependencies, the rule-applying and problem-solving behaviors required by most good combination tasks are probably best taught as separate component subclasses of instructional tasks.

So far we have discussed two dimensions of our functional typology: antecendent-performance relations, and their level of complexity. The third dimension of our classification system is the selection of proficiency standards for completing a terminal task. Van Houten (1979) has described a two-stage process that we heartily recommend. First, normative data on the performance of those individuals identified as "truly competent" are gathered. Independent judges may also be used to subjectively rate the degree of competence demonstrated by those labeled "competent". For example, one might measure the frequency with which highly competent graduate students or faculty members in a discipline can identify examples and nonexamples of a concept.[9] Second, the normative range of performance demonstrated by competent individuals is subjected to experimental analysis. For example, one could compare the degree of retention, extension, and transfer that results when students are trained to different frequency criteria within the range of performance demonstrated by those labeled "competent". Training a student to complete a minimum of five Example Identification tasks per minute, for example, may lead to the greatest extended performance on new Example Identification tasks and combination tasks that require Example Identification behavior.

This minimum rate would be optimal if it increased the likelihood that the student could also demonstrate proficient example-request behavior and define/describe behavior with little or no student or teacher effort (transfer). Proficiency criteria derived from such experimentation will guarantee maximum future learning.

Teaching Terminal Tasks Selected From the Typology

Figure two illustrates a sequence of terminal instructional tasks for teaching the concept, tau effect in a college course (Johnson & Chase, 1979; Chase,1980).[10] The sequence includes the three major varieties of conceptual instraverbal tasks and some combination tasks. Accurate performance on these tasks would be followed by a proficiency building phase, in which the students would practice until they could define the tau effect, and compare and contrast the tau and kappa effects in one minute or less, classify a minimum of five scenarios per minute as examples and nonexamples, give at least two original examples in a one-minute timing, and answer at least one combination task per minute in a five minute sample. These proficiency criteria are exemplary and probably vary from discipline to discipline. Successful completion of a proficiency training program occurs when student rates of task performance match those rates generated by individuals labeled competent professionals.

Insert Figure 2 About Here

Instructional programs for experienced learners should focus upon sequences of complex conceptual tasks taken from column two. In order to guarantee conceptual performance, fixed intraverbal performance and tasks that promote it must be avoided: Define/Describe tasks should not use word sequences taken directly from the text and should ask the student to answer in his own words.

Figure 2

Exemplary study program for the concept, tau effect.

1. Define the tau effect in your own words.

2. Say how the tau effect differs from the kappa effect.

3. Say which of the following are examples of the "tau effect":

a. Todd saw a picture of Cheryl Tiegs modeling a bathing suit in Sports Illustrated one day in 1973. When he saw her on Cover Girl makeup ads two years later, he told his girlfriend that he had predicted that she would make it big someday. Later that day, he saw her on a talk show, and commented on how lucky he was to be able to see her twice in one day.

b. Cindy likes bikini bathing suits on men. While at the beach one afternoon last summer, she saw a guy with a blue bikini. Two weeks later, she saw another guy wearing a blue bikini, and pointed out to her friend Liz that she and seen the same suit two weeks ago and thought that it would look good on her friend Joe. When she went to the beach again the next day, Liz pointed out the same blue bikini on someone else, but Cindy said the suit she liked is light green.

c. Mary and Rod went to see "For Pete's Sake", starring Robert Redford. The next day they went to see "Butch Cassidy and the Sundance Kid". Rod pointed out that Robert Redford was in both movies. Three months later, they went to see "All the President's Men", which also starred Robert Redford. Mary asked, "Isn't that Robert Redford?" Rod replied, "Nah, that's Paul Newman."

d. Teddy likes to buy Crackerjacks. He gets the prizes and then gives them away to his friends. Once he got two blue secret decoder rings in the same box. He went running to his mother and told her that he got the same prize twice. He gave one of the rings to his friend Joe. Three weeks later, he was visiting Joe and asked him where he got the blue secret decoder ring. Joe told Ted that he had given it to him. Joe said, "I thought that I had given you a red one."

e. For one homework problem, Lisa had to factor the equation $4X^2 + 6X + 4$. In class the next day, the students had a quiz on which that problem was included. She solved the problem, and thanked the teacher for putting the homework problem on the quiz. Two weeks later, the same problem appeared again on an exam. After the exam was over, the teacher laughingly asked Lisa whether any of the problems looked familiar. Lisa said that she didn't think so.

4. Give an original example of the tau effect.

5. Illustrate how the tau effect and the kappa effect differ. Be original.

6. Change the nonexamples of the tau effect in #3 above to examples.

7. Jacques learned to name the painting, "Crows Over a Wheatfield" by Van Gogh, in his Art History class. Do you think he would be more likely to name it if he saw it in Newsweek the following week, or if he saw it in

the Lincoln Center a month later? Justify your answer.

8. Kim was reading the newspaper the other day and noticed a little blurb about Carter's energy policy. The next day, she saw another article on Carter's energy policy, and told her friend Carl that there had been two separate articles in two days about Carter's energy policy. A month later, in a State-of-the-Union address, Carter expounded further on his energy policy. Kim told Carl how she was glad to hear that Carter had expanded his energy policy.

Say whether the above is an example of the kappa effect or the tau effect. If it is one of these two concepts, justify your answer. If it is not one of these two concepts, rewrite the passage to make it illustrate the concept to which it is closest. Then justify the changes that you made.

Example Identification tasks should contain illustrations that are maximally unlike those presented in previous instruction. Finally, Example-request tasks should specifically request an original example of each feature of a concept.

Selection and specification of terminal tasks and proficiency criteria may indeed be sufficient for guaranteeing proficient performance from above-average college and graduate students. However, program tryout may reveal the need for presenting longer sequences of tasks that incorporate instructional procedures like prompting, fading and shaping. Discussion of the design of such longer sequences of tasks is beyond the scope of this paper. The interested reader should consult Tiemann and Markle (1978), Markle (1978), Becker, Englemann, and Thomas (1975), Englemann and Carnine (1980), and Johnson and Chase (1979).

In our experience there is also a growing number of high school and college students and professionals in training programs who lack or are weak in prerequisite learning behaviors characteristic of elementary task performance. It is highly likely that the pace at which students can engage in elementary prerequisite tasks like reading; memorizing words, definitions, and examples; and copying from text will determine their success in meeting quality and pace standards for conceptual tasks. For example, Van Houten (1979) found that increasing the frequency of completing basic, single-digit multiplication facts improved the quality and pace of completing long multiplication and long division tasks.[11] Haughton (1972; 1979) also suggested that similar relations exist between the frequency of saying and writing morphemes, words, and the alphabet; and the accuracy and rate of more complex tasks like spelling, reading and composition. For students weak in elementary prerequisite task proficiency, we recommend including a dose of tasks from column one in programs and on tests. Practice with explicitly stated elementary tasks, usually assumed to be in the repertoires of experienced learners at proficient rates, may significantly increase accurate and fluent conceptual task

completion.

Our illustration of terminal tasks in figure two was designed for typical college classroom instruction. The typology is not limited to classroom application, however. Inservice training programs can teach a wider range of tasks than is usually possible in classrooms. For example, a teacher-training curriculum could include tasks that require trainees to identify instances of reinforcement and punishment during observations of trained teachers (conceptual tact task), and comment on the adequacy of modeling procedures used by peers in the training program (conceptual combination: tact plus Define/Describe, and possibly some Example-request.)

Validation of the Typology

Can other content experts correctly sort specific instructional tasks into the subclasses of the typology? Does the typology cover the range of instructional tasks that define the goals of all advnaced classroom and training program instruction? How much training do potential users need in order to accurately and fluently use the typology? (Williams, 1977). The answers to these questions should tell us something about the clarity generality, and utility of the typology for people involved in instruction.

In order to answer these questions, we began by writing a program that describes and illustrates five of the subclasses of tasks and their definitions (transcriptive: Copy task; conceptual intraverbal: Define/Describe, Example Identification, Example-request; Conceptual Combination). These tasks were selected because of their importance to our own instructional design. An undergraduate research assistant then selected and classified ten tasks from our own instructional design, and ten tasks from commercially available Educational and Introductory Psychology study guides and test item files. We then verified the assistant's breadth of selection and accuracy of classification , and wrote the following quiz to test the program's effectiveness:

1. Name the kind of instructional task illustrated by each of the following items (Example Identification task): (20 instructional tasks followed.)

2. List any objectives, test items, or questions that could not be classified in the typology (Nonexample-request task.)

The assistant then presented our program and the set of twenty instructional tasks to eight graduate and two undergraduate students involved in departmental teaching responsibilities at the University of Massachusetts/Amherst. Each task was accompanied by a summary of the instructional passage that accompanied it. Subjects' reading and classifying behavior were electronically timed. After classifying the tasks, subjects were asked to list any objectives, test items, or questions that could not be classified in the typology. Subjects were given feedback as one of the typology designers scored their answers. The designer and research assistant reached 98% agreement in scoring the subjects' answer sheets.

Table one presents the results of our empirical test. Mean percent agreement between graduate students and one of the typology designers in sorting tasks into classes of the typology (Example Identification task) was 89.38; designer agreement with undergraduates was 82.5. Agreement with all students was 88. Eight of the ten subjects agreed with the designer on at least 90% of the classifications. Mean percent agreement between designer and graduates on tasks written by the typology developers was 95. Percent agreement with undergraduates was 95. Combined agreement was 95%. All of the ten subjects agreed with the designer on at least 90% of the classifications.

Mean percent agreement between designer and graduates on commercially available tasks was 83.75; agreement with undergraduates was 70%. Mean percent agreement between designer and all students on commercially available task sorting was 81. Four of the ten subjects agreed with the designer on at least 90% of the classifications. Mean reading duration was 21.9 minutes. Mean classification duration was 27.38 minutes, or 1.37/minute. No subject was able to specify a task that was not covered by the typology. One subject suggested that Define/Describe tasks be further partitioned into simple definition.description, and compare/contrast tasks.

Insert Table 1 About Here

Table 1

Agreement Between Subjects and Typology Designer In Sorting Tasks Into Classes of the Functional Typology

	Percent Agreement												
	Graduate Students								Undergraduate Students		Graduate Students' Mean Percent	Undergraduate Students' Mean Percent	Combined Mean Percent
	1	2	3	4	5	6	7	8	1	2			
All 20 Tasks	90	95	90	90	90	90	90	80	90	75	89	83	88
Commercial Tasks	90	100	90	80	80	90	80	60	80	60	84	70	81
Our Tasks	90	90	90	100	100	90	100	100	100	90	95	95	95
	Minutes												
Reading Duration	23	18	26	27	21	15	16	25	25	23	24	21	22
Sorting Duration	--	25	--	26	20	24	43	26	32	23	28	27	27

Three ambiguous tasks accounted for most of the disagreements. Summaries of the instructional passages related to these tasks did not clearly indicate whether the information given in the instructional passages was the same as the information given in the task, or whether the learner would have encountered the task answer during instruction. If the original passages had been made available to the subject, as would be the case in practical application of the typology, perhaps the high level of agreement would have been even higher.

On the basis of this experiment, several minor revisions in the typology and the program were made. The program has also been expanded to cover all subclasses, and has recently been subjected to reader feedback. We are pleased with the results of our first validation study; none of the other classification systems produce anywhere near such agreement among classifiers, the closest being 46% agreement between Williams and his thirteen classifiers (McGuire,1963; Popham, 1969; Stanley & Bolton, 1957; Williams, 1977).

We plan further improvements by conducting validations that are different from our first one in at least five ways. First, since undergraduate student classification was much poorer than graduate student classification, a group of undergraduates will test the full program. Second, graduate students and instructors in a range of departments at our own and other institutions of higher education will participate. Third, we will ask these participants to classify their own study and test items in addition to those we select. Fourth,we will define fluent classification performance based on our own rates and time participants' practice until they reach such criteria. Such fluency building should help increase the likelihood that the typology will be used during the participants' owninstructional design (Haughton, 1972, 1979; Van Houten, 1979; White & Haring, 1976). Eventually we hope to complete a manual that trains instructors to select and design instructional tasks from the typology for their own courses (i.e., Johnson & Chase, 1979).

Fifth, we will conduct cost/benefit analyses of the use of our typology. In our series of validation studies, we will compare retention, extention, and transfer among groups with different amounts and kinds of instructional tasks, with a control group that does not have instructional tasks based upon the typology. Instructional design efficiency could also be investigated by comparing the effects of different methods for generating tasks upon program length and design time, and student performance and study time.

Conclusion

While we are satisfied with the results of our initial validation, expanded tryout and revision should help make our typology a standard vehicle of current instructional practice, increasing communication and broadening the range of instructional tasks included in higher education.

A standard typology will also facilitate progress in instructional research by making interstudy comparisons possible. It can also be used to determine the most efficient instructional programs. For example, our transfer of training research has been designed to determine how learning each class of instructional tasks transfers to a variety of other instructional tasks. It asks whether it is necessary to teach each class of instructional tasks specified in a typology; perhaps students will be able to demonstrate all of the verbal skills after direct instruction on only some of them. Perhaps the frequency with which classes of instructional tasks can be completed partially determines the extent or degree of transfer to other verbal tasks. Perhaps prose content and style interact with the kinds and amounts of tasks that are needed. Once the nature of transfer across classes of verbal tasks is known, instructional materials that guarantee complex learning can be designed in an efficient and effective manner. Such instructional materials would

include only those tasks and proficiency criteria that facilitate transfer to the full range of "cognitive behaviors". Further research could determine the most efficient sequence of instructional tasks within and across curricula, as well. We are currently conducting research laboratories at the University of Massachusetts and Central Washington University to answer these questions.

A standard typology with accompanying instructional program may also supplement existing study skills training programs by teaching students to generate their own study tasks from the typology. Research consistently indicates that students have few opportunities to ask questions in an environment in which they receive feedback for their efforts, and few, if any, study skills programs focus upon this feature of student learning (Gall, 1970).

Finally, a standard typology should also clarify the relation between instructional goals and the effectiveness of other behavioral instruction procedures, such as mastery criteria, review tests, study questions, and unit assignment length (Johnson & Ruskin, 1977). We predict that the kinds of instructional tasks an instructor uses has a lot to do with the degree to which a particular behavioral procedure or even a whole system of instruction is effective.

Cognitive psychologists should not be so quick to bury behavioral influences in instructional design under a "cognitive revolution," as some have called it (e.g., Anderson & Biddle, 1975; Faw & Waller, 1976; Rickards, 1979; Wittrock & Lumsdaine, 1977.) Behavior analysts have only scratched the surface of Skinner's (1957) Verbal Behavior.[12] It may yet spawn another "behavioral revolution" in instruction!

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Footnotes

[1] This paper describes the evolution of a set of procedures for coming to grips with the verbal components of what is meant by competent performance. Motor skill development and competence awaits further analysis.

[2] We reference an early attempt by Gagne to classify instructional tasks, not his well-known work in the area of learning heirarchies (e.g., Gagne, 1977).

[3] Many more classification systems have been designed for elementary instruction, including schemata that focus upon teachers' oral questions (e.g., Gallagher, 1967; Pate & Bremer, 1967) students' questions (e.g., Carner, 1963) and curriculum-specific questions in disciplines such as art (Clements, 1964), and reading (Guzak, 1967).

[4] Skinner also discusses two other kinds of extension, both based upon stimulus features that the verbal community does not consider critical to the particular tact. In our parlance, if the new instance embodies some but not all of the defining features of stimuli previously labeled that way, then the speaker is engaging in metaphorical extension of the tact. Identifying a wolf as a dog, banjo music as guitar music, a potential hint as a prompt when it doesn't help locate the criminal, and an instance of extinction as an instance of punishment all illustrate metaphorical extension. Metaphorical extension is not always "undesirable"; the community often reinforces it. For example, literary analysis is often metaphorical, as when twentieth century existential poetry or plays are called "thirteenth century renaissance works". Creative writing courses often teach metaphorical extension. Indeed Shakespeare's line, "Juliet is like the sun", is a classical example of metaphorical extension. A third kind of extension occurs when the new instance embodies none of the defining features of the stimulus previously labeled that way. Skinner calls this metonymical extension, another desirable conceptual goal for some writing courses. Metonymical extension often occurs to stimuli that accompany other stimuli, as when a reporter writes, "The White House says..." or when we say, "Where is the salt?" when we see the pepper shaker. Much more has been written about these forms of extension, a discussion of which is beyond the scope of the present paper.

[5] How many students can correctly pronounce "tachistoscope" on their first encounter ???

[6] But see Skinner (1957), Peterson (1978) and Segal (1975).

[7] In prior versions of our functional typology (Johnson & Chase, 1978; 1979), Example identification tasks were given a category of their own, called the approximate tact, to emphasize their similarity to tacts. Notice that Example Identification tasks differ from tact tasks only in that the antecedent is a pure and neutral verbal description of the nonverbal antecedent for the tact. In our latest version of the typology, we have decided to remain true to Skinner's definitions and system and include Example Identification tasks among the intraverbals. Research remains to demonstrate their facilitative effect upon the learning of tacts.

[8] Adopted from Williams, 1977.

[9] Johnston and Pennypacker (1971) measured graduate student rates to define proficiency criteria for filling in blanks in Define/Describe tasks used in undergraduate psychology courses.

[10] Note that our version of the psychophysics concept, tau effect, is greatly expanded from its original definition (e.g., Helson and King, 1931; Bill and Teft, 1969).

[11] Van Houten also noted that students' single-digit multiplication was error-free before fluency building. Thus, if the usual instructional diagnosis based solely on accuracy had been made, the additional practice on single-digit multiplication that improved the proficiency and accuracy of long multiplication and division would not have been provided.

[12] Most fruitfully in the area of supplementary stimulation (e.g., prompting and probing; Markle, 1969; 1978).